

US010212845B2

(12) **United States Patent**  
**Dunn et al.**

(10) **Patent No.:** **US 10,212,845 B2**  
(45) **Date of Patent:** **\*Feb. 19, 2019**

(54) **HYBRID REAR COVER AND MOUNTING BRACKET FOR ELECTRONIC DISPLAY**

(58) **Field of Classification Search**  
CPC ..... H05K 7/20972; H05K 5/0204; H05K 7/20145; H05K 7/2039; H05K 5/0017;  
(Continued)

(71) Applicant: **Manufacturing Resources International, Inc.**, Alpharetta, GA (US)

(56) **References Cited**

(72) Inventors: **William Dunn**, Alpharetta, GA (US);  
**Marcos Diaz**, Alpharetta, GA (US);  
**Kyle Azevedo**, Alpharetta, GA (US)

U.S. PATENT DOCUMENTS

2,029,221 A 1/1936 Burgess et al.  
2,678,860 A 5/1954 Peterson  
(Continued)

(73) Assignee: **Manufacturing Resources International, Inc.**, Alpharetta, GA (US)

FOREIGN PATENT DOCUMENTS

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

AU 2011248190 B2 5/2011  
CN 2702363 Y 5/2005  
(Continued)

This patent is subject to a terminal disclaimer.

OTHER PUBLICATIONS

Itsenclosures, Product Catalog, 2009, 48 pages.  
(Continued)

(21) Appl. No.: **15/494,614**

(22) Filed: **Apr. 24, 2017**

*Primary Examiner* — Adam B Dravininkas

(74) *Attorney, Agent, or Firm* — Standley Law Group LLP

(65) **Prior Publication Data**

US 2017/0231112 A1 Aug. 10, 2017

(57) **ABSTRACT**

**Related U.S. Application Data**

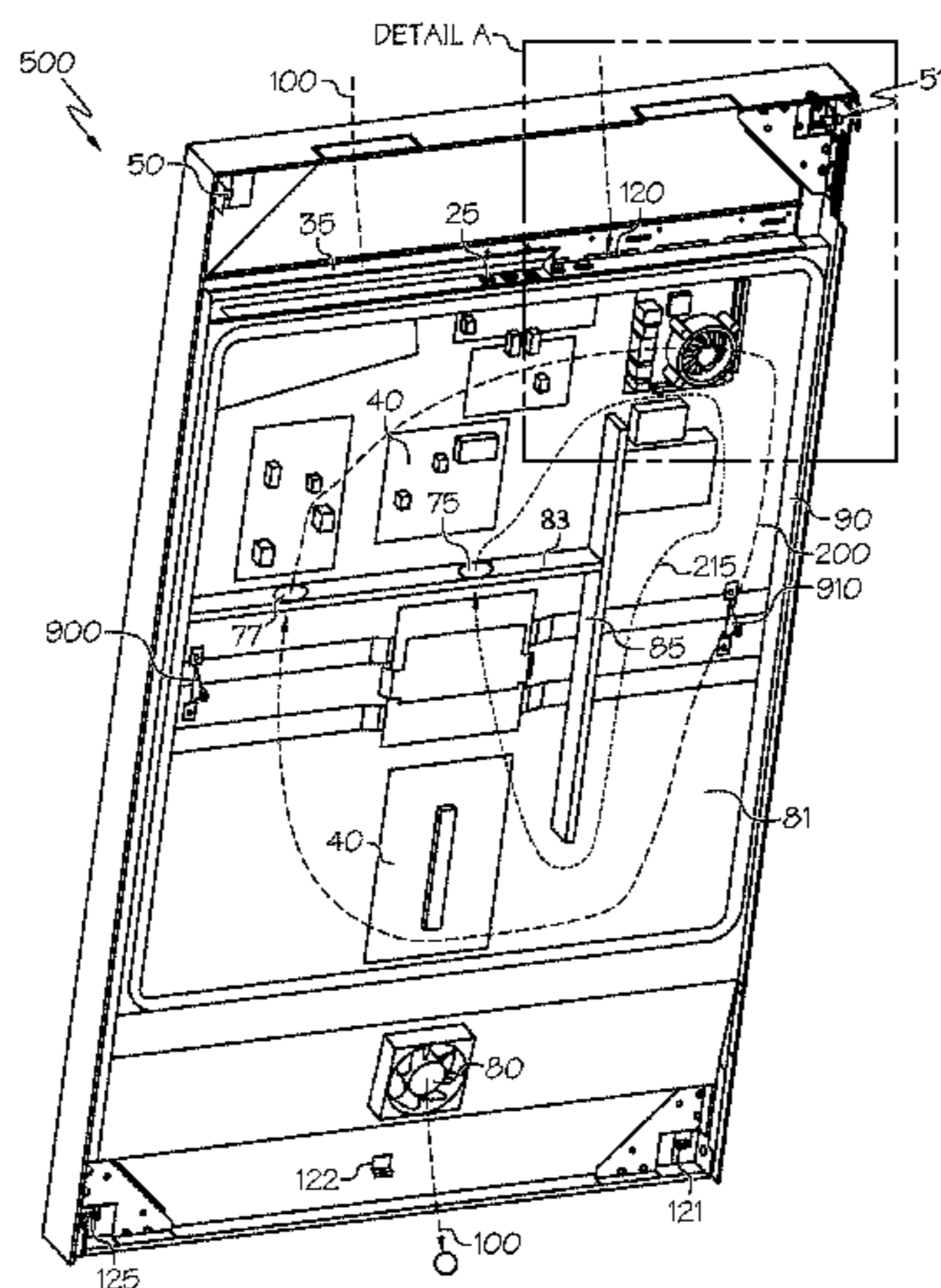
(63) Continuation of application No. 14/645,076, filed on Mar. 11, 2015, now Pat. No. 9,655,289.  
(Continued)

A system and method for mounting an electronic display is disclosed herein. A rear cover mounting bracket may contain a rear plate and a sidewall which surrounds a perimeter of the plate. A plurality of mounting holes may be placed within the plate to allow fastening the rear plate to a vertical surface. An electronic display assembly module may contain a thermal plate where the attachment of the rear cover mounting bracket to the module creates a plenum which can house one or more electronic components. In a preferred embodiment, the rear plate contains a pair of hooks and the module contains a pair of corresponding cylinders which can be engaged with the hooks so that the module can hang from the hooks.

(51) **Int. Cl.**  
**H05K 7/20** (2006.01)  
**G02F 1/133** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ... **H05K 7/20145** (2013.01); **G02F 1/133308** (2013.01); **G06F 1/1601** (2013.01);  
(Continued)

**19 Claims, 6 Drawing Sheets**



- Related U.S. Application Data**
- (60) Provisional application No. 61/951,344, filed on Mar. 11, 2014.
- (51) **Int. Cl.**  
*H04N 5/64* (2006.01)  
*G02F 1/1333* (2006.01)  
*H05K 5/00* (2006.01)  
*H05K 7/18* (2006.01)  
*G06F 1/16* (2006.01)  
*G02F 1/1335* (2006.01)
- (52) **U.S. Cl.**  
 CPC ..... *H04N 5/64* (2013.01); *H05K 5/0017* (2013.01); *H05K 7/18* (2013.01); *H05K 7/2039* (2013.01); *H05K 7/20972* (2013.01); *G02F 1/133603* (2013.01); *G02F 2001/133314* (2013.01); *G02F 2001/133628* (2013.01); *Y10T 29/49826* (2015.01)
- (58) **Field of Classification Search**  
 CPC ..... G02F 1/133308; G02F 1/133603; G02F 2001/133628; G02F 2001/133314; G02F 1/1333; H04N 5/64; Y10T 29/49826  
 See application file for complete search history.

(56) **References Cited**  
 U.S. PATENT DOCUMENTS

3,984,931 A 10/1976 Belokin, Jr.  
 4,093,355 A 6/1978 Kaplit et al.  
 4,169,327 A 10/1979 Stilling  
 4,267,657 A 5/1981 Kloke  
 4,327,513 A 5/1982 de Gunzburg  
 4,452,000 A 6/1984 Gandy  
 4,547,987 A 10/1985 Stilling  
 4,593,978 A 6/1986 Mourey et al.  
 4,634,225 A 1/1987 Haim et al.  
 4,748,765 A 6/1988 Martin  
 4,759,143 A 7/1988 Pomerleau  
 4,763,993 A 8/1988 Voageley et al.  
 4,817,317 A 4/1989 Kovalak, Jr.  
 4,903,423 A 2/1990 Hinca  
 4,905,390 A 3/1990 Stilling  
 4,921,041 A 5/1990 Akachi  
 4,952,783 A 8/1990 Aufderheide et al.  
 4,952,925 A 8/1990 Haastert  
 5,029,982 A 7/1991 Nash  
 5,088,806 A 2/1992 McCartney et al.  
 5,247,374 A 9/1993 Terada  
 5,282,114 A 1/1994 Stone  
 5,293,930 A 3/1994 Pitasi  
 5,299,109 A 3/1994 Grondal  
 5,423,142 A 6/1995 Douglas et al.  
 5,432,526 A 7/1995 Hyatt  
 5,457,905 A 10/1995 Kaplan  
 5,493,802 A 2/1996 Simson  
 5,535,816 A 7/1996 Ishida  
 D373,120 S 8/1996 Andre et al.  
 5,559,614 A 9/1996 Urbish et al.  
 5,621,614 A 4/1997 O'Neill  
 5,657,641 A 8/1997 Cunningham et al.  
 5,717,424 A 2/1998 Simson et al.  
 5,748,269 A 5/1998 Harris et al.  
 5,755,050 A 5/1998 Aiken  
 5,765,743 A 6/1998 Sakiura et al.  
 5,767,489 A 6/1998 Ferrier  
 5,803,424 A 9/1998 Keehn et al.  
 5,808,418 A 9/1998 Pitman et al.  
 5,818,010 A 10/1998 McCann  
 5,818,694 A 10/1998 Daikoku et al.  
 5,835,179 A 11/1998 Yamanaka  
 5,864,465 A 1/1999 Liu  
 5,869,818 A 2/1999 Kim

5,869,919 A 2/1999 Sato et al.  
 5,899,027 A 5/1999 St. Louis  
 5,903,433 A 5/1999 Gudmundsson  
 D415,736 S 10/1999 Witte  
 5,991,153 A 11/1999 Heady et al.  
 6,003,015 A 12/1999 Kang et al.  
 6,007,205 A 12/1999 Fujimori  
 6,050,833 A 4/2000 Danzyger et al.  
 6,089,751 A 7/2000 Conover et al.  
 6,104,451 A 8/2000 Matsuoka et al.  
 6,157,432 A 12/2000 Helbing  
 6,172,869 B1 1/2001 Hood, III et al.  
 6,181,070 B1 1/2001 Dunn et al.  
 6,191,839 B1 2/2001 Briley et al.  
 6,198,222 B1 3/2001 Chang  
 6,211,934 B1 4/2001 Habing et al.  
 6,215,655 B1 4/2001 Heady et al.  
 6,231,446 B1 5/2001 Majima et al.  
 6,351,381 B1 2/2002 Bilski et al.  
 6,392,727 B1 5/2002 Larson et al.  
 6,405,463 B1 6/2002 Roddy et al.  
 6,417,900 B1 7/2002 Shin et al.  
 6,428,198 B1 8/2002 Saccomanno et al.  
 6,469,752 B1 10/2002 Ishikawa et al.  
 6,473,150 B1 10/2002 Takushima et al.  
 D467,561 S 12/2002 Kosciolek  
 6,493,440 B2 12/2002 Gromatsky et al.  
 6,494,429 B2 12/2002 Tajima  
 6,504,713 B1 1/2003 Pandolfi et al.  
 6,535,266 B1 3/2003 Nemeth et al.  
 6,557,284 B2 5/2003 Nolan  
 6,628,355 B1 9/2003 Takahara  
 6,714,410 B2 3/2004 Wellhofer  
 6,727,468 B1 4/2004 Nemeth  
 6,748,685 B2 6/2004 Peel  
 6,758,002 B1 7/2004 Duguay  
 6,825,828 B2 11/2004 Burke et al.  
 6,839,104 B2 1/2005 Taniguchi et al.  
 6,885,412 B2 4/2005 Ohnishi et al.  
 6,886,942 B2 5/2005 Okada et al.  
 6,891,135 B2 5/2005 Pala et al.  
 6,909,486 B2 6/2005 Wang et al.  
 6,943,768 B2 9/2005 Cavanaugh et al.  
 6,961,108 B2 11/2005 Wang et al.  
 6,962,528 B2 11/2005 Yokota  
 6,976,330 B2 12/2005 Milliken  
 7,015,470 B2 3/2006 Faytlin et al.  
 7,059,757 B2 6/2006 Shimizu  
 7,083,285 B2 8/2006 Hsu et al.  
 D530,686 S 10/2006 Reza  
 7,157,838 B2 1/2007 Thielemans et al.  
 7,161,803 B1 1/2007 Heady  
 7,190,587 B2 3/2007 Kim et al.  
 7,209,349 B2 4/2007 Chien et al.  
 7,210,839 B2 5/2007 Jung et al.  
 7,212,403 B2 5/2007 Rockenfeller  
 D544,848 S 6/2007 Marz et al.  
 7,226,176 B1 6/2007 Huang  
 7,269,023 B2 9/2007 Nagano  
 7,284,874 B2 10/2007 Jeong et al.  
 7,292,435 B2 11/2007 She  
 7,339,782 B1 3/2008 Landes et al.  
 7,452,121 B2 11/2008 Cho et al.  
 7,457,113 B2 11/2008 Kumhyr et al.  
 7,480,140 B2 1/2009 Hara et al.  
 7,513,830 B2 4/2009 Hajder et al.  
 7,535,543 B2 5/2009 Dewa et al.  
 D595,678 S 7/2009 Dunn  
 7,589,958 B2 9/2009 Smith  
 7,601,067 B2 10/2009 Anderson  
 7,602,469 B2 10/2009 Shin  
 7,609,506 B2 10/2009 Aguirre  
 D608,775 S 1/2010 Leung  
 7,667,964 B2 2/2010 Kang et al.  
 7,752,858 B2 7/2010 Johnson et al.  
 7,753,567 B2 7/2010 Kang et al.  
 7,768,775 B2 8/2010 Kim  
 7,800,706 B2 9/2010 Kim et al.  
 7,813,124 B2 10/2010 Karppanen



(56)

References Cited

U.S. PATENT DOCUMENTS

7,903,416 B2	3/2011	Chou	2003/0104210 A1	6/2003	Azumi et al.
7,985,139 B2	7/2011	Lind et al.	2003/0128511 A1	7/2003	Nagashima et al.
7,995,342 B2	8/2011	Nakamichi et al.	2003/0214785 A1	11/2003	Perazzo
8,004,648 B2	8/2011	Dunn	2004/0012722 A1	1/2004	Alvarez
8,006,435 B2	8/2011	DeBlonk et al.	2004/0025389 A1	2/2004	Peterson
8,016,452 B2	9/2011	Dunn	2004/0035558 A1	2/2004	Todd et al.
8,035,968 B2	10/2011	Kwon et al.	2004/0036834 A1	2/2004	Ohnishi et al.
8,081,465 B2	12/2011	Nishiura	2004/0103570 A1	6/2004	Ruttenberg
8,102,173 B2	1/2012	Merrow	2004/0105159 A1	6/2004	Saccomanno et al.
8,116,081 B2	2/2012	Crick, Jr.	2004/0165139 A1	8/2004	Anderson et al.
8,142,027 B2	3/2012	Sakai	2004/0212548 A1	10/2004	Ruttenberg
8,208,115 B2	6/2012	Dunn	2004/0223299 A1	11/2004	Ghosh
8,223,311 B2	7/2012	Kim et al.	2004/0257492 A1	12/2004	Mai et al.
8,241,573 B2	8/2012	Banerjee et al.	2005/0012039 A1	1/2005	Faytlin et al.
8,248,784 B2	8/2012	Nakamichi et al.	2005/0012722 A1	1/2005	Chon
8,254,121 B2	8/2012	Lee et al.	2005/0062373 A1	3/2005	Kim et al.
8,269,916 B2	9/2012	Ohkawa	2005/0073632 A1	4/2005	Dunn et al.
8,270,163 B2	9/2012	Nakamichi et al.	2005/0073639 A1	4/2005	Pan
8,274,622 B2	9/2012	Dunn	2005/0105178 A1	5/2005	Kim
8,274,789 B2	9/2012	Nakamichi et al.	2005/0127796 A1	6/2005	Olesen et al.
8,300,203 B2	10/2012	Nakamichi et al.	2005/0134525 A1	6/2005	Tanghe et al.
8,320,119 B2	11/2012	Isoshima et al.	2005/0134526 A1	6/2005	Willem et al.
8,351,014 B2	1/2013	Dunn	2005/0213950 A1	9/2005	Yoshimura
8,358,397 B2	1/2013	Dunn	2005/0229630 A1	10/2005	Richter et al.
8,369,083 B2	2/2013	Dunn et al.	2005/0237714 A1	10/2005	Ebermann
8,373,841 B2	2/2013	Dunn	2005/0276053 A1	12/2005	Nortrup et al.
8,379,182 B2	2/2013	Dunn	2005/0286131 A1	12/2005	Saxena et al.
8,400,608 B2	3/2013	Takahashi et al.	2006/0012958 A1	1/2006	Tomioaka et al.
8,418,387 B2	4/2013	Swatt et al.	2006/0012985 A1	1/2006	Archie, Jr. et al.
8,472,174 B2	6/2013	Idems et al.	2006/0018093 A1	1/2006	Lai et al.
8,472,191 B2	6/2013	Yamamoto et al.	2006/0034051 A1	2/2006	Wang et al.
8,482,695 B2	7/2013	Dunn	2006/0056994 A1	3/2006	Van Lear et al.
8,497,972 B2	7/2013	Dunn et al.	2006/0077636 A1	4/2006	Kim
8,537,302 B2	9/2013	Dunn	2006/0082271 A1	4/2006	Lee et al.
8,649,170 B2	2/2014	Dunn et al.	2006/0092348 A1	5/2006	Park
8,649,176 B2	2/2014	Okada et al.	2006/0125998 A1	6/2006	Dewa et al.
8,654,302 B2	2/2014	Dunn et al.	2006/0132699 A1*	6/2006	Cho ..... F04D 29/582
8,678,603 B2	3/2014	Zhang	2006/0137294 A1	6/2006	349/161
8,693,185 B2	4/2014	Dunn et al.	2006/0177587 A1	6/2006	Waits et al.
8,700,226 B2	4/2014	Schuch et al.	2006/0199514 A1	8/2006	Ishizuka et al.
8,711,321 B2	4/2014	Dunn et al.	2006/0209266 A1	9/2006	Kimura
8,749,749 B2	6/2014	Hubbard	2006/0215421 A1	9/2006	Utsunomiya
8,755,021 B2	6/2014	Hubbard	2006/0218828 A1	9/2006	Chang et al.
8,760,613 B2	6/2014	Dunn	2006/0218828 A1	10/2006	Schrimpf et al.
8,767,165 B2	7/2014	Dunn	2006/0260790 A1	11/2006	Theno et al.
8,773,633 B2	7/2014	Dunn et al.	2006/0262079 A1	11/2006	Seong et al.
8,804,091 B2	8/2014	Dunn et al.	2006/0266499 A1	11/2006	Choi et al.
8,823,916 B2	9/2014	Hubbard et al.	2006/0283579 A1	12/2006	Ghosh et al.
8,854,572 B2	10/2014	Dunn	2007/0019419 A1	1/2007	Hafuka et al.
8,854,595 B2	10/2014	Dunn	2007/0021217 A1	1/2007	Wu
8,879,042 B2	11/2014	Dunn	2007/0030879 A1	2/2007	Hatta
8,988,647 B2	3/2015	Hubbard	2007/0047239 A1	3/2007	Kang et al.
9,030,641 B2	5/2015	Dunn	2007/0065091 A1	3/2007	Hinata et al.
9,089,079 B2	7/2015	Dunn	2007/0070615 A1	3/2007	Joslin et al.
9,119,325 B2	8/2015	Dunn et al.	2007/0076431 A1	4/2007	Atarashi et al.
9,119,330 B2	8/2015	Hubbard et al.	2007/0103863 A1	5/2007	Kim
9,173,322 B2	10/2015	Dunn	2007/0103866 A1	5/2007	Park
9,173,325 B2	10/2015	Dunn	2007/0115686 A1	5/2007	Tyberghien
9,282,676 B1	3/2016	Diaz	2007/0139574 A1	6/2007	Ko et al.
9,456,525 B2	9/2016	Yoon et al.	2007/0139929 A1	6/2007	Yoo et al.
2001/0001459 A1	5/2001	Savant et al.	2007/0140671 A1	6/2007	Yoshimura
2001/0019454 A1	9/2001	Tadic-Galeb et al.	2007/0151274 A1	7/2007	Roche et al.
2001/0043290 A1	11/2001	Yamamoto	2007/0151664 A1	7/2007	Shin
2001/0043293 A1	11/2001	Inoue	2007/0171353 A1	7/2007	Hong
2002/0033919 A1	3/2002	Sanelle et al.	2007/0206158 A1	9/2007	Kinoshita et al.
2002/0101553 A1	8/2002	Enomoto et al.	2007/0211205 A1	9/2007	Shibata
2002/0126248 A1	9/2002	Yoshia	2007/0212211 A1	9/2007	Chiyoda et al.
2002/0148600 A1	10/2002	Bosch et al.	2007/0217221 A1	9/2007	Lee et al.
2002/0149714 A1	10/2002	Anderson et al.	2007/0237636 A1	10/2007	Hsu
2002/0154255 A1	10/2002	Gromatzky et al.	2007/0253205 A1	11/2007	Welker
2002/0164944 A1	11/2002	Haglid	2007/0267174 A1	11/2007	Kim
2002/0167637 A1	11/2002	Burke et al.	2007/0276507 A1	11/2007	Bertram et al.
2003/0007109 A1	1/2003	Park	2008/0002350 A1	1/2008	Farrugia
2003/0020884 A1	1/2003	Okada et al.	2008/0055534 A1	3/2008	Kawano
2003/0039094 A1	2/2003	Sarkinen et al.	2008/0076342 A1	3/2008	Bryant et al.
			2008/0099193 A1	5/2008	Aksamit et al.
			2008/0100186 A1	5/2008	Li
			2008/0148609 A1	6/2008	Ogoreve
			2008/0209934 A1	9/2008	Richards



(56)

References Cited

U.S. PATENT DOCUMENTS

2008/0218446 A1 9/2008 Yamanaka  
 2008/0236005 A1 10/2008 Isayev et al.  
 2008/0255901 A1 10/2008 Carroll et al.  
 2008/0267790 A1 10/2008 Gaudet et al.  
 2008/0283234 A1 11/2008 Sagi et al.  
 2008/0285290 A1 11/2008 Ohashi et al.  
 2008/0304219 A1 12/2008 Chen  
 2009/0009041 A1 1/2009 Leidler  
 2009/0009047 A1\* 1/2009 Yanagawa ..... H05K 7/20009  
 313/46  
 2009/0009729 A1 1/2009 Sakai  
 2009/0016004 A1 1/2009 McCoy  
 2009/0086430 A1 4/2009 Kang et al.  
 2009/0104989 A1 4/2009 Williams et al.  
 2009/0120629 A1 5/2009 Ashe  
 2009/0122218 A1\* 5/2009 Oh ..... G02F 1/133385  
 361/679.21  
 2009/0126906 A1 5/2009 Dunn  
 2009/0126907 A1 5/2009 Dunn  
 2009/0126914 A1 5/2009 Dunn  
 2009/0135365 A1 5/2009 Dunn  
 2009/0141199 A1 6/2009 Fujikawa  
 2009/0147170 A1 6/2009 Oh et al.  
 2009/0154096 A1 6/2009 Iyengar et al.  
 2009/0174626 A1 7/2009 Isoshima et al.  
 2009/0231807 A1 9/2009 Bouissiere  
 2009/0241388 A1 10/2009 Dunn  
 2009/0244472 A1 10/2009 Dunn  
 2009/0278007 A1 11/2009 Taylor  
 2009/0279240 A1 11/2009 Karppanen  
 2009/0302727 A1 12/2009 Vincent et al.  
 2009/0306820 A1 12/2009 Simmons et al.  
 2010/0060861 A1 3/2010 Medin  
 2010/0079949 A1 4/2010 Nakamichi et al.  
 2010/0162747 A1 7/2010 Hamel et al.  
 2010/0171889 A1 7/2010 Pantel et al.  
 2010/0182562 A1 7/2010 Yoshida et al.  
 2010/0220249 A1\* 9/2010 Nakamichi ..... H05K 5/02  
 348/836  
 2010/0226091 A1 9/2010 Dunn  
 2010/0232107 A1 9/2010 Dunn  
 2010/0238394 A1 9/2010 Dunn  
 2010/0321887 A1 12/2010 Kwon et al.  
 2011/0001898 A1 1/2011 Mikubo et al.  
 2011/0013114 A1 1/2011 Dunn et al.  
 2011/0019348 A1 1/2011 Kludt et al.  
 2011/0019363 A1 1/2011 Vahlsing et al.  
 2011/0051071 A1 3/2011 Nakamichi et al.  
 2011/0058326 A1 3/2011 Idems et al.  
 2011/0075361 A1 3/2011 Nakamichi et al.  
 2011/0083460 A1 4/2011 Thomas et al.  
 2011/0083824 A1 4/2011 Rogers  
 2011/0085301 A1 4/2011 Dunn  
 2011/0114384 A1 5/2011 Sakamoto et al.  
 2011/0116000 A1 5/2011 Dunn et al.  
 2011/0116231 A1\* 5/2011 Dunn ..... H04N 5/64  
 361/695  
 2011/0122162 A1\* 5/2011 Sato ..... G02F 1/133385  
 345/690  
 2011/0134356 A1 6/2011 Swatt et al.  
 2011/0141672 A1 6/2011 Farley, Jr. et al.  
 2011/0141724 A1 6/2011 Erion  
 2011/0227467 A1 9/2011 Foppe, Jr. et al.  
 2011/0261523 A1 10/2011 Dunn et al.  
 2012/0006523 A1 1/2012 Masahiro et al.  
 2012/0012295 A1 1/2012 Kakiuchi et al.  
 2012/0012300 A1 1/2012 Dunn et al.  
 2012/0014063 A1 1/2012 Weiss  
 2012/0020114 A1 1/2012 Miyamoto et al.  
 2012/0038849 A1 2/2012 Dunn et al.  
 2012/0044217 A1 2/2012 Okada et al.  
 2012/0050958 A1 3/2012 Sanford et al.  
 2012/0106081 A1 5/2012 Hubbard et al.  
 2012/0206687 A1 8/2012 Dunn et al.

2012/0249402 A1 10/2012 Kang  
 2012/0255704 A1 10/2012 Nakamichi  
 2012/0274876 A1 11/2012 Cappaert et al.  
 2012/0284547 A1 11/2012 Culbert et al.  
 2013/0170140 A1 7/2013 Dunn  
 2013/0201685 A1 8/2013 Messmore et al.  
 2013/0211583 A1 8/2013 Borra  
 2013/0258659 A1 10/2013 Erion  
 2013/0270975 A1 10/2013 Dunn et al.  
 2013/0294039 A1\* 11/2013 Chao ..... H05K 5/0204  
 361/752  
 2014/0044147 A1 2/2014 Wyatt et al.  
 2014/0085564 A1 3/2014 Hendren et al.  
 2014/0111758 A1 4/2014 Dunn et al.  
 2014/0113540 A1 4/2014 Dunn et al.  
 2014/0208626 A1 7/2014 Moon  
 2014/0313698 A1 10/2014 Dunn et al.  
 2014/0314395 A1 10/2014 Dunn et al.

FOREIGN PATENT DOCUMENTS

EP 1408476 A1 4/2004  
 EP 1647766 A2 4/2006  
 EP 1762892 A1 3/2007  
 EP 1951020 A1 7/2008  
 EP 2225603 A2 9/2010  
 EP 2370987 A2 10/2011  
 EP 2603831 A2 6/2013  
 GB 153110 11/1920  
 GB 2402205 A 12/2004  
 JP 402062015 A 3/1990  
 JP 402307080 A 12/1990  
 JP 3153212 A 7/1991  
 JP 6082745 A 3/1994  
 JP 8115788 A 5/1996  
 JP 8194437 A 7/1996  
 JP 8339034 A 12/1996  
 JP H09246766 A 9/1997  
 JP 11160727 A 6/1999  
 JP H11296094 A 10/1999  
 JP 2001209126 A 8/2001  
 JP 2002158475 A 5/2002  
 JP 2004053749 A 2/2004  
 JP 2005017556 A 1/2005  
 JP 2000131682 A 5/2005  
 JP 2005134849 A 5/2005  
 JP 2005265922 A 9/2005  
 JP 2005292939 A 10/2005  
 JP 2005332253 A 12/2005  
 JP 2006513577 A 4/2006  
 JP 2007322718 A 5/2006  
 JP 2006148047 A 6/2006  
 JP 2006163217 A 6/2006  
 JP 2006198344 8/2006  
 JP 2007003638 A 1/2007  
 JP 09307257 A 11/2007  
 JP 2008010361 A 1/2008  
 JP 2008292743 A 12/2008  
 JP 2010024624 A 2/2010  
 KR 200163508 Y1 7/2000  
 KR 200206768 Y1 12/2000  
 KR 200236278 Y1 10/2001  
 KR 2002-0057425 A 7/2002  
 KR 200286961 Y1 8/2002  
 KR 200366674 Y1 11/2004  
 KR 20050033986 A 4/2005  
 KR 200401354 Y1 11/2005  
 KR 20060016469 A 2/2006  
 KR 100666961 B1 1/2007  
 KR 1020070070675 A 4/2007  
 KR 1020070048294 8/2007  
 RU 2513043 C2 4/2014  
 WO WO2005079129 A1 8/2005  
 WO WO2008050660 A2 5/2008  
 WO WO2009065125 A2 5/2009  
 WO WO2009065125 A3 5/2009  
 WO WO2009135308 A1 11/2009  
 WO WO2010007821 A1 2/2010  
 WO WO2010080624 A2 7/2010

(56)

**References Cited**

FOREIGN PATENT DOCUMENTS

WO	WO2011059793	A2	5/2011
WO	2011069084	A3	6/2011
WO	WO2011072217	A3	6/2011
WO	WO2011140179	A1	11/2011
WO	WO2011150078	A2	12/2011
WO	WO2012006620	A2	1/2012
WO	WO2012021573	A2	2/2012
WO	WO2012024426	A3	2/2012

OTHER PUBLICATIONS

Itsenclosures, Standard Product Data Sheet, 2011, 18 pages.  
 Sunbritetv, All Weather Outdoor LCD Television Model 4610HD, 2008, 1 page.  
 Sunbritetv, Introduces Two New All-Weather Outdoor Televisions InfoComm 2008, 7 pages.  
 Itsenclosures, Viewstation, 2017, 16 pages.  
 Novitsky, Driving LEDs versus CCFLs for LCD backlighting, Nov. 12, 2007, 6 pages.

Federman, Cooling Flat Panel Displays, 2011, 4 pages.  
 Zeeff, T.M., EMC analysis of an 18" LCD monitor, 2000, 1 page.  
 I-Tech Company, 65" Outdoor Digital Signage Sunlight All Weather Proof LCD, 1 Page.  
 sunlightlcd.com, 46" All Weather NEMA4 Outdoor High Brightness (Model: GS4600L), Mar. 11, 2009, 2 Pages.  
 Wankhede, Evaluation of Cooling Solutions for Outdoor Electronics, Sep. 17-19, 2007, 6 pages.  
 Bureau of Ships Navy Department, Guide Manual of Cooling methods for Electronic Equipment, Mar. 31, 1955, 212 pages.  
 Scott, Cooling of Electronic Equipment, Apr. 4, 1947, 119 pages.  
 Sergeant, Thermal Management Handbook for Electronic Assemblies, Aug. 14, 1998, 190 pages.  
 Steinberg, Cooling Techniques for Electronic Equipment First Edition, 1980, 255 pages.  
 Steinberg, Cooling Techniques for Electronic Equipment Second Edition, 1991, 299 pages.  
 Yeh, Thermal Management of Microelectronic Equipment, Oct. 15, 2002, 148 pages.

\* cited by examiner





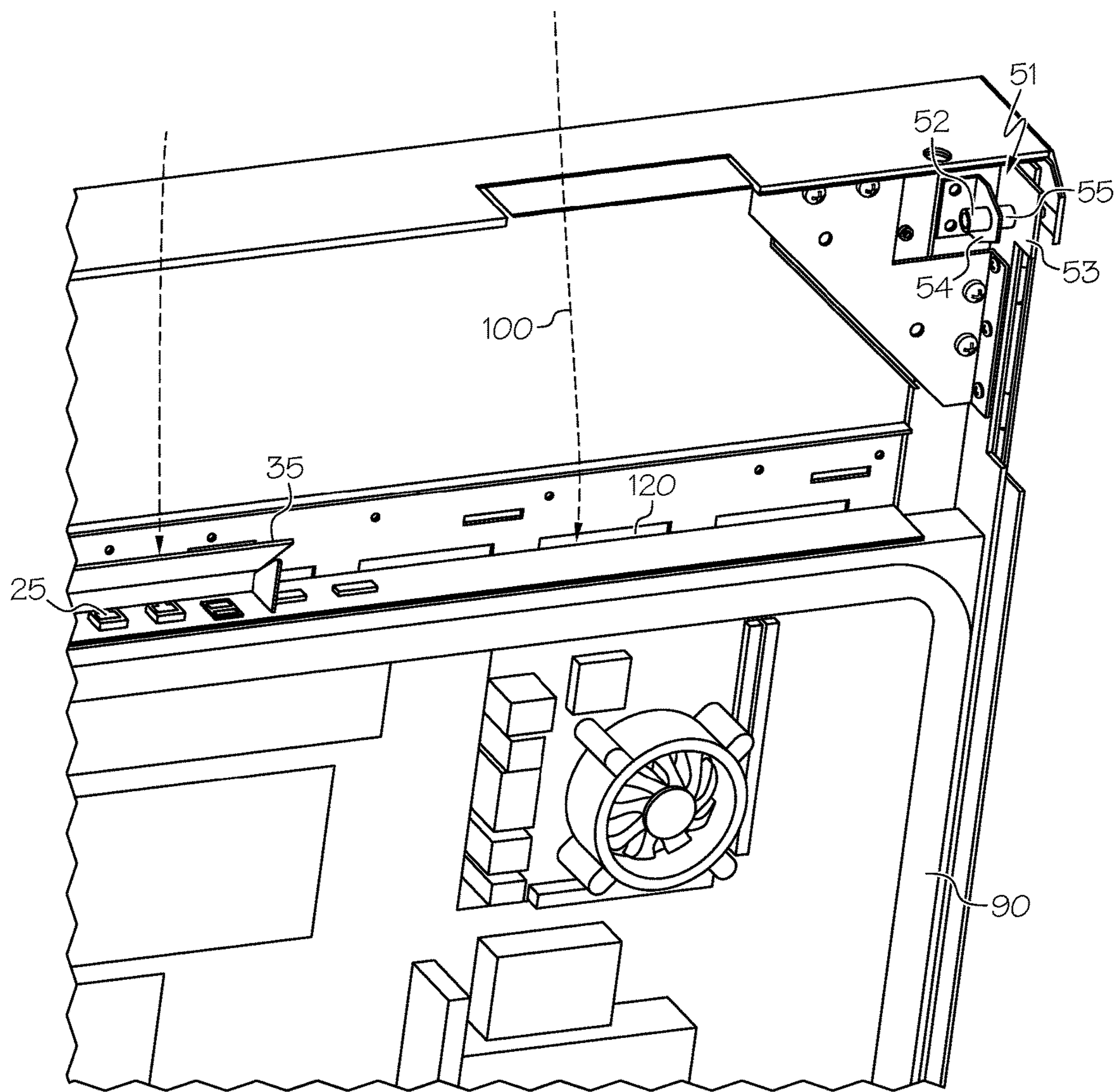


FIG. 2

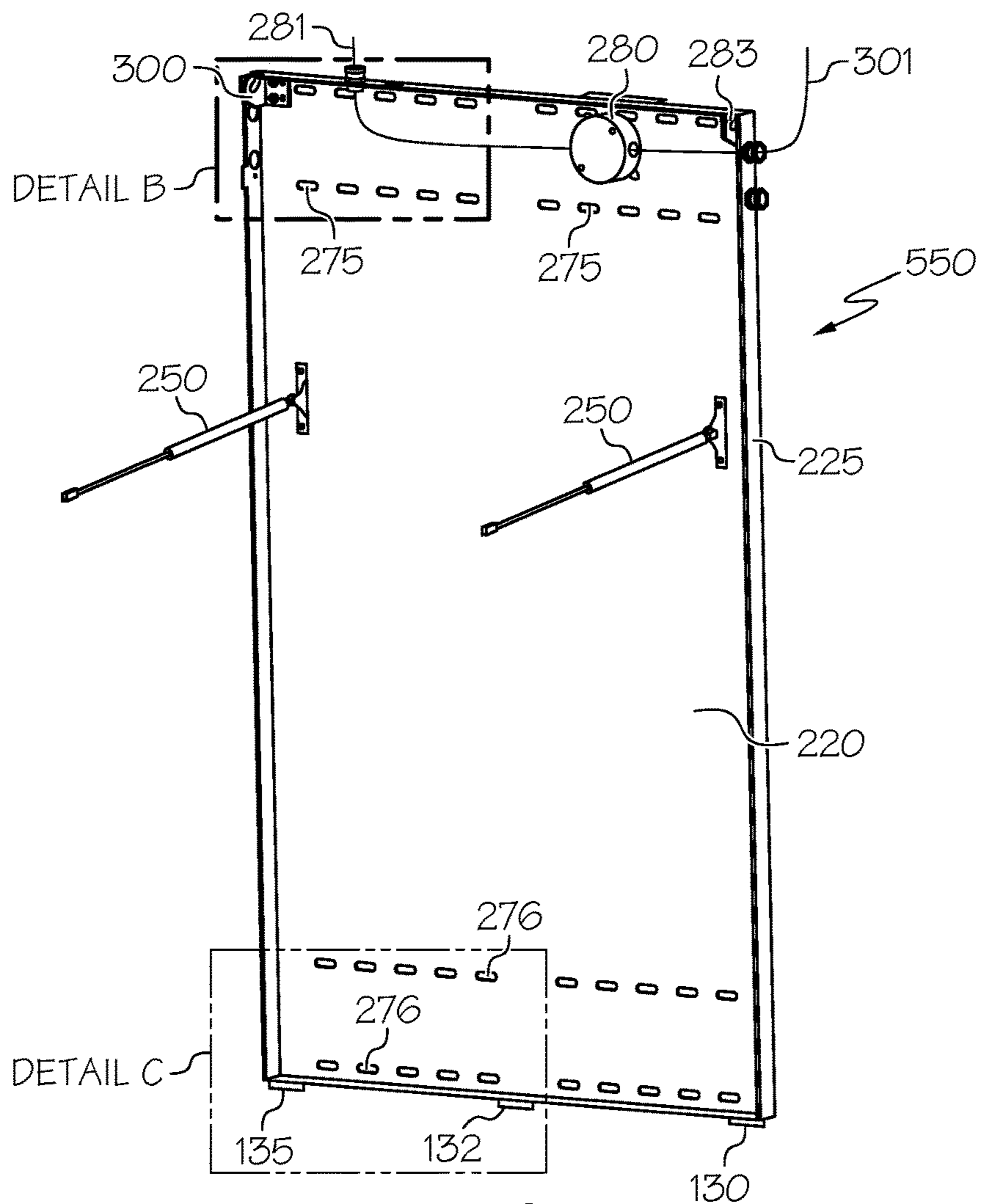


FIG. 3

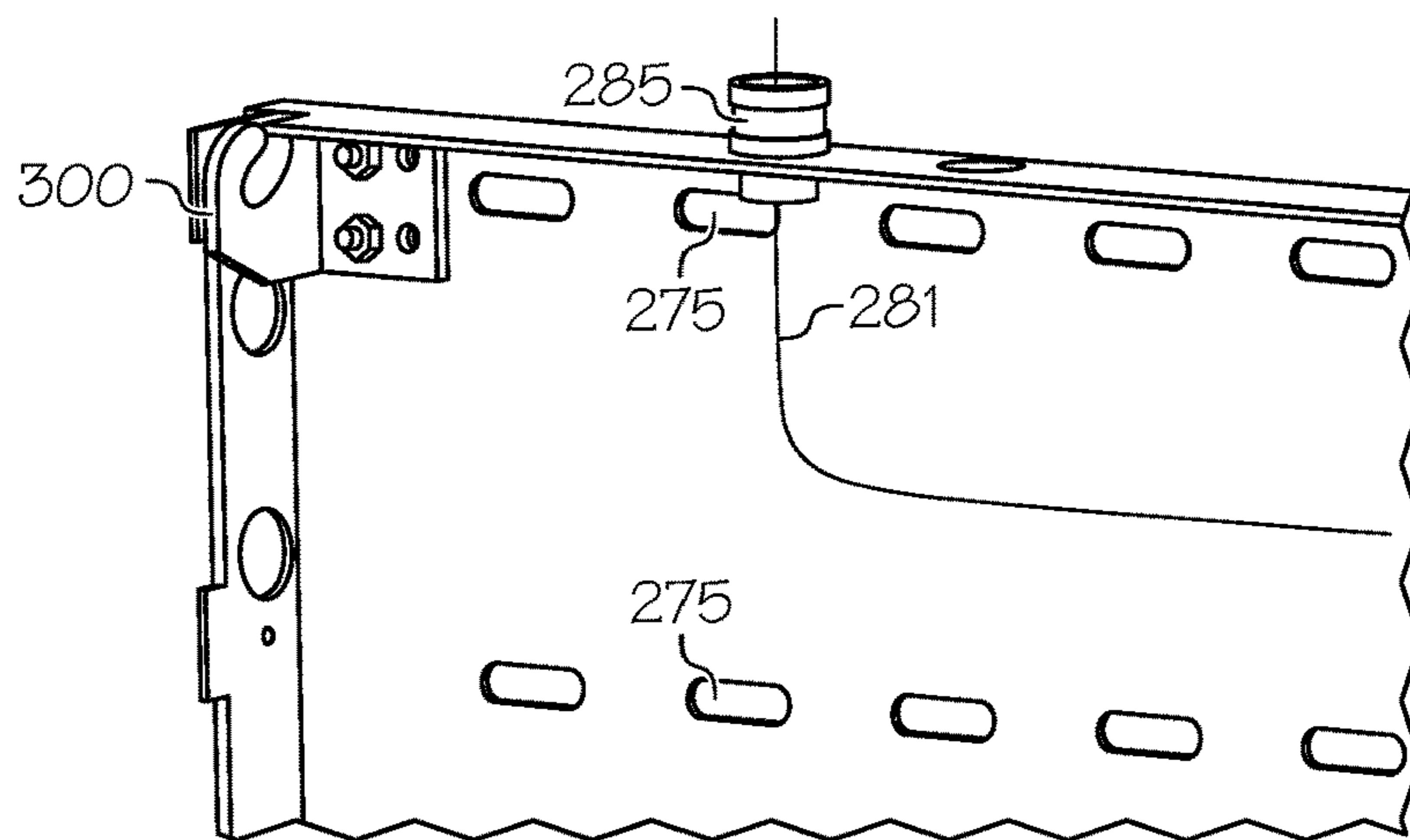
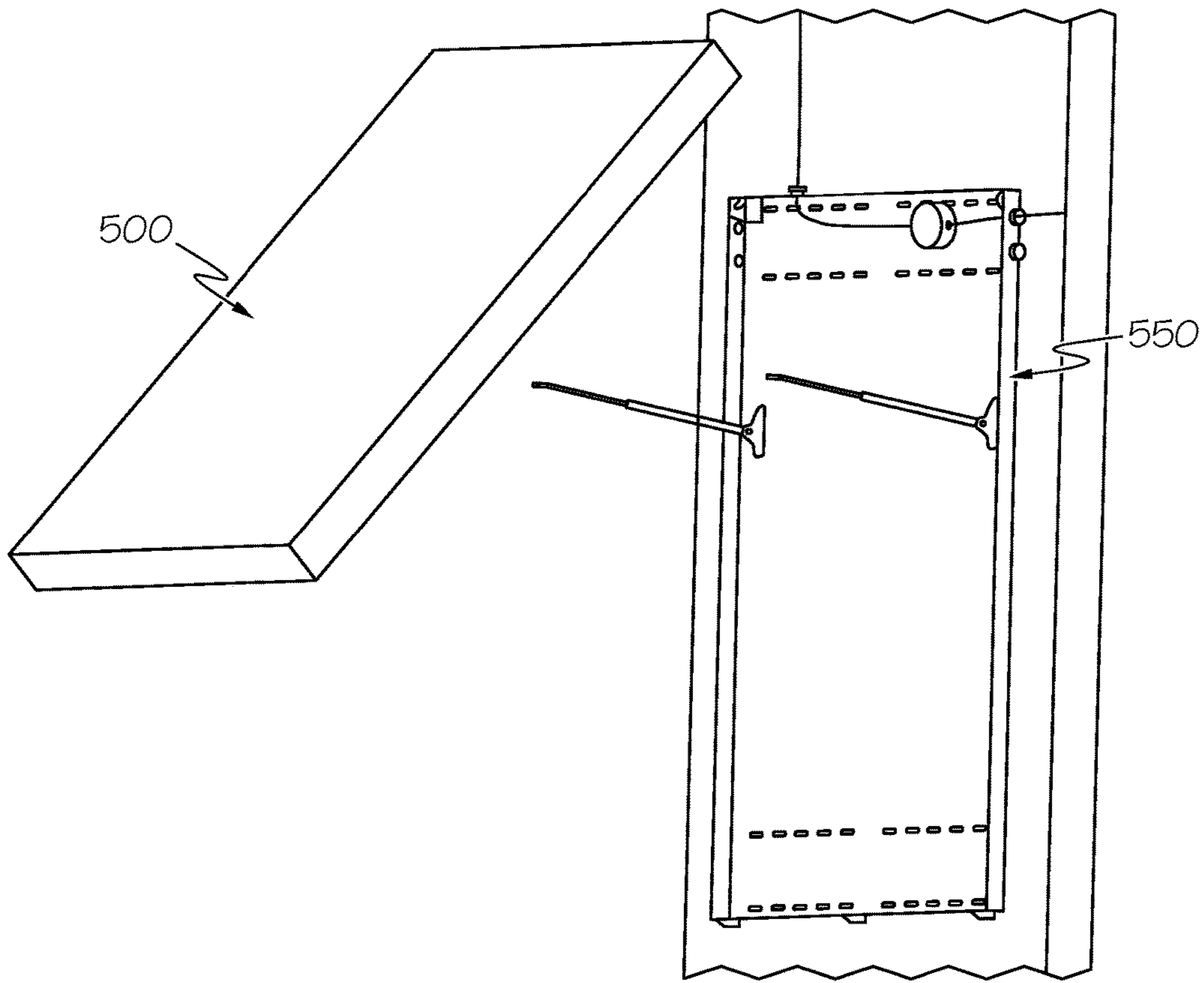
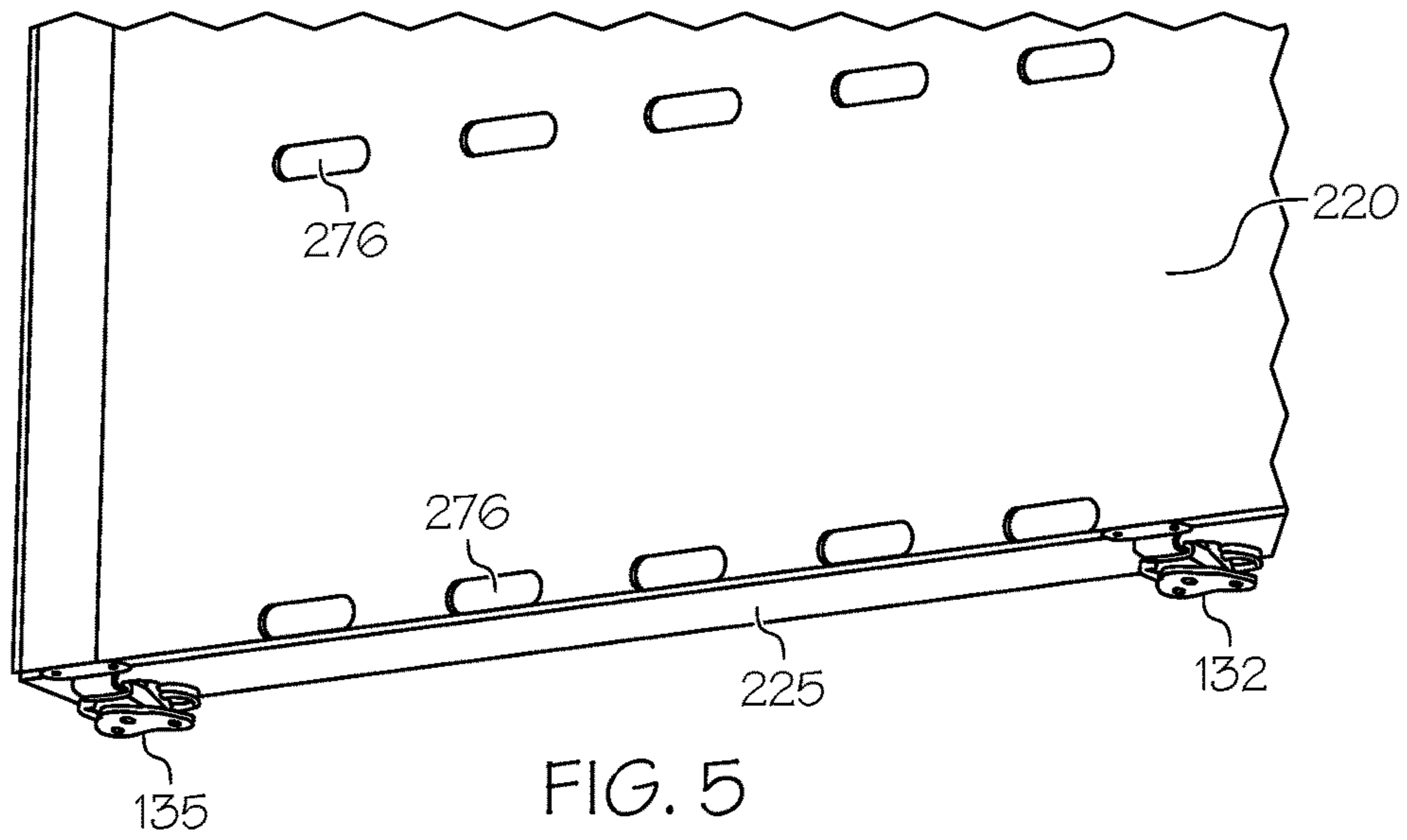


FIG. 4





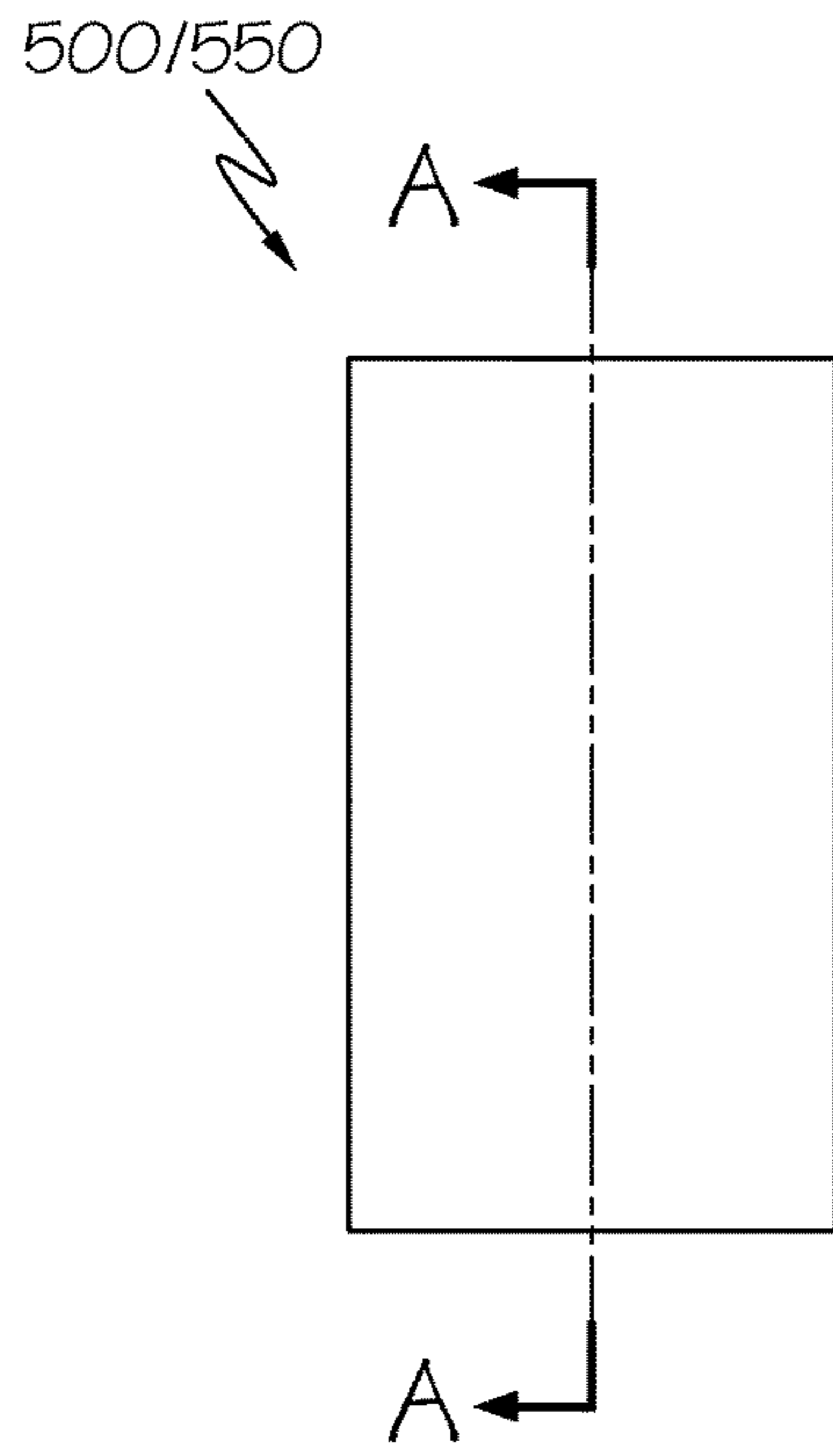


FIG. 7

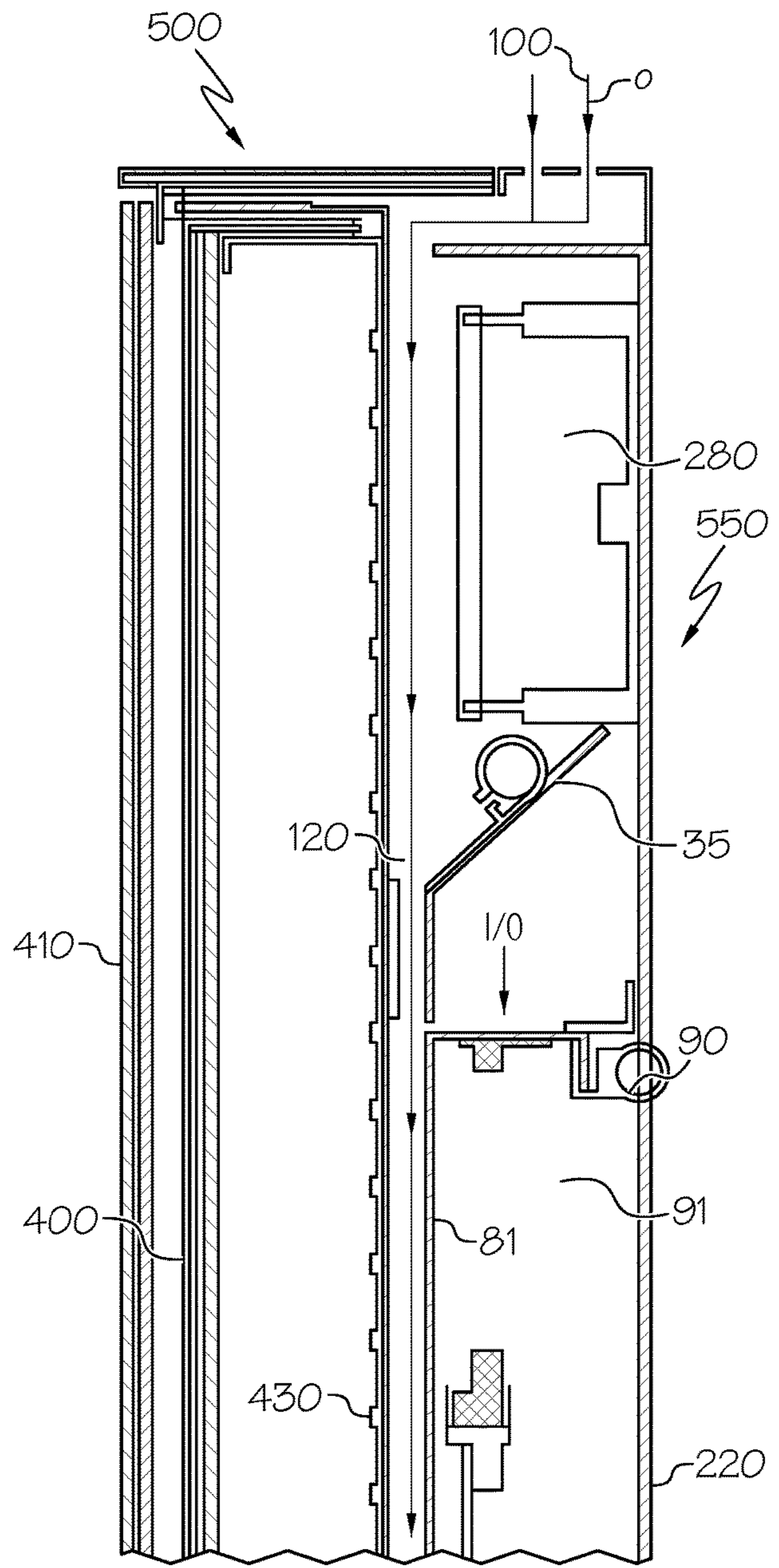


FIG. 8



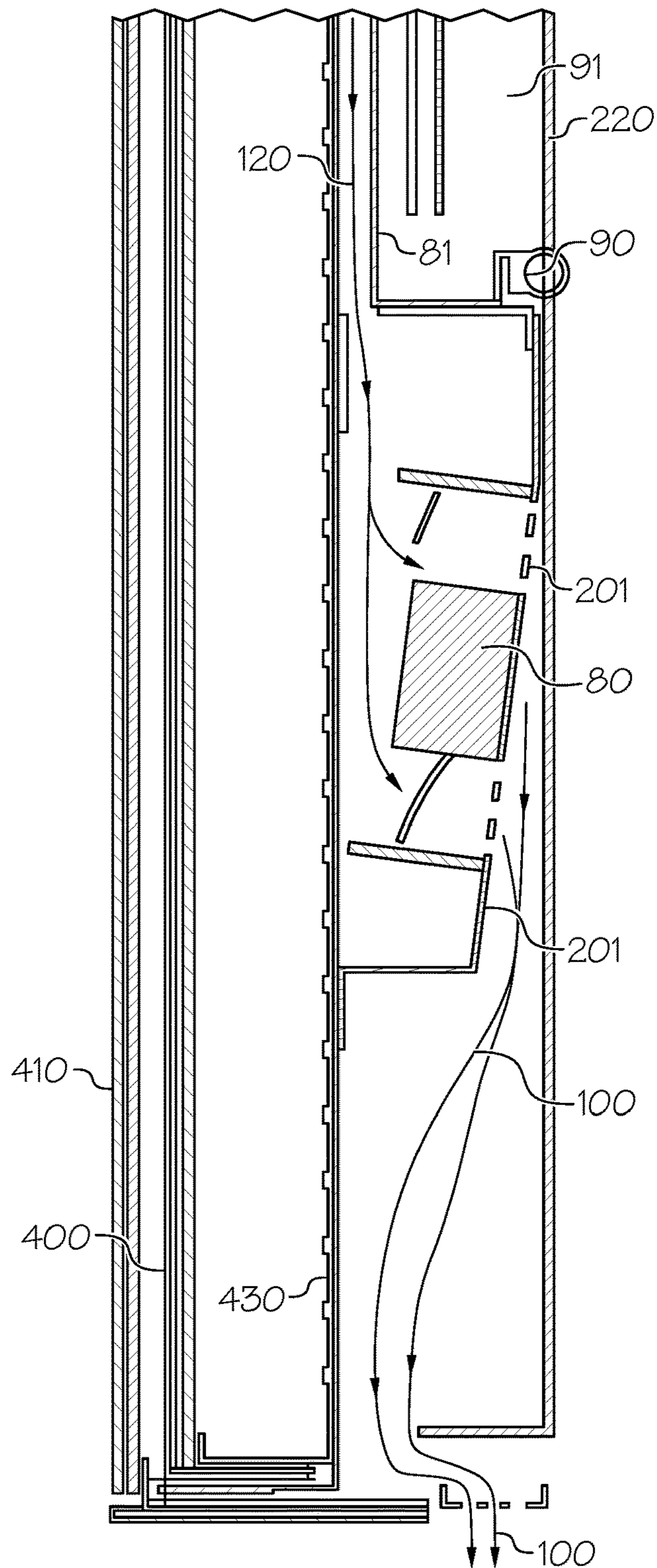


FIG. 9



1

## HYBRID REAR COVER AND MOUNTING BRACKET FOR ELECTRONIC DISPLAY

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 14/645,076 filed on Mar. 11, 2015, which claims priority to U.S. Provisional Application No. 61/951,344 filed on Mar. 11, 2014. Both aforementioned applications are incorporated by reference as if fully recited herein.

### TECHNICAL FIELD

Embodiments generally relate to systems and methods for installing and cooling electronic displays.

### BACKGROUND OF THE ART

Electronic displays are sometimes used in outdoor environments or other areas where the surrounding temperatures may be high or there may be other sources of heat such as solar loading causing the temperatures within the display to rise. However, some portions of the display can be difficult to cool as simply ingesting ambient air into some portions of the display can introduce dust and contaminates into sensitive portions of the display, which can lead to premature failures. Further, it is now desirable to provide an improved system for installing large electronic displays in public areas.

### SUMMARY OF THE EXEMPLARY EMBODIMENTS

A system and method for mounting an electronic display is disclosed herein. A rear cover mounting bracket may contain a rear plate and a sidewall which surrounds a perimeter of the plate. A plurality of mounting holes may be placed within the plate to allow fastening the rear plate to a vertical surface. An electronic display assembly module may contain a thermal plate where the attachment of the rear cover mounting bracket to the module creates a plenum which can house one or more electronic components. In a preferred embodiment, the rear plate contains a pair of hooks and the module contains a pair of corresponding cylinders which can be engaged with the hooks so that the module can hang from the hooks.

The foregoing and other features and advantages of the present invention will be apparent from the following more detailed description of the particular embodiments, as illustrated in the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

FIG. 1 is a rear perspective view of an exemplary electronic display assembly module showing Detail A.

FIG. 2 is a detailed rear perspective view of Detail A shown in FIG. 1.

FIG. 3 is a front perspective view of an exemplary hybrid rear cover and mounting bracket, once fastened to a vertical surface and connected to service wiring.

FIG. 4 is a detailed front perspective view of Detail B shown in FIG. 3.

2

FIG. 5 is a detailed front perspective view of Detail C shown in FIG. 3.

FIG. 6 is a front perspective view of the exemplary method for attaching the electronic display assembly module to the hybrid rear cover and mounting bracket.

FIG. 7 is a front elevation view of the hybrid rear cover and mounting bracket once assembled with the electronic display assembly module and indicating the section line A-A.

FIG. 8 is a partial section view taken along the section line A-A and showing the top portion of the assembly.

FIG. 9 is a partial section view taken along the section line A-A and showing the bottom portion of the assembly.

### DETAILED DESCRIPTION

The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Embodiments of the invention are described herein with reference to illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

FIG. 1 is a rear perspective view of an exemplary electronic display assembly module **500** showing Detail A. A thermal mounting sheet **81** is placed behind the electronic display and contains a plurality of electrical assemblies **40** which may include but are not limited to: power supplies, video players, hard drives, microprocessors, printed circuit boards, and input/output electronics. A narrow channel **120** is preferably defined by the space between the thermal sheet **81** and the rear surface of the electronic display. External air **100** may be forced through the channel **120** by fan **80**, which



can then extract heat from both the rear surface of the electronic display as well as the thermal mounting sheet **81**.

A gasket **90** is preferably attached to the thermal mounting sheet **81** and surrounds a portion of the perimeter of the thermal mounting sheet **81**. When combined with the hybrid rear cover mounting bracket **550**, the gasket **90** and sheet **81** define a gaseously-sealed plenum **91** which may contain the electrical assemblies **40**. One or more fans **75/77** may cause the air within the plenum **91** to circulate around. Preferably, a pair of dividing walls **83/85** are used to define a loop around the plenum **91** which passes through only one of the dividing walls (here **83**). In an exemplary embodiment, dividing wall **83** is perpendicular to dividing wall **85**. Even more preferably, dividing wall **83** is arranged horizontally and contains the fan(s) while dividing wall **85** is connected to the end of dividing wall **83** but is arranged vertically and does not contain a fan. For exemplary airflow, it has been discovered that placing the first fan **75** near the center of the display assembly and the second fan **77** near the perimeter of the display assembly, causes a pair of circulating gas loops **215** and **200** respectfully. Preferably, the plenum **91** is sealed so that external air cannot enter the plenum **91** (and preferably prevents air, or any other gaseous matter with or without particulate, from exiting the plenum **91**).

A plurality of input/output electrical connections **25** are preferably placed at the top of the module **500** and underneath a water guard **35**. Also, a pair of mounting pins **50** and **51** are arranged at the top of the module **500**. A trio of latches **121**, **122**, **125** are preferably arranged at the bottom of the module **500**, although embodiments can be practiced within one or two latches only. Also shown in this figure are the attachment brackets **900** and **910** for gas springs **250** or other supporting resistive elements.

FIG. **2** is a detailed rear perspective view of Detail A shown in FIG. **1**. Here, the details of the mounting pin (or rod or cylinder) **51** may be observed. In this embodiment, this can be described as a cylinder which travels horizontally and may be divided by two locating walls **53** (closest to the perimeter of the module **500**) and **54** (closest to the center of the module **500**). The cylinder can then be identified by the mounting portion **55** (located between walls **53/54**) and the interior portion **52** (starting at the wall **54** and travelling towards the center of the module **500**). The mounting pins can be solid or hollow and are preferably cylindrical.

FIG. **3** is a front perspective view of an exemplary hybrid rear cover and mounting bracket **550** (herein cover/bracket **550**), once fastened to a vertical surface and connected to service wiring **281**. The cover/bracket **500** preferably contains a substantially flat rear plate **220** with a sidewall **225** which surrounds the plate **220**. A plurality of mounting holes **275** are preferably placed near the top of the cover/bracket **500** while another plurality of mounting holes **276** are placed near the bottom of the cover/bracket **500**. In this way, the cover/bracket **500** can easily be mounted on a vertical surface where the service wiring **281** can be routed through the sidewall **225** and into a junction box **280** by a designated electrician. A second service line **283** may also exit the junction box **280** and could run to a second display module, allowing several cover/brackets to be installed and wired together in a daisy chain fashion. Generally, this electrical work requires permits, licenses, and/or approval by an electrical inspector. With this exemplary embodiment, this work can be completed and approved before the electronic display modules **500** are even shipped to the location.

A pair of gas springs **250** or other resistive device may be attached to the rear plate **220** and correspond with the attachment plates **900/910** on the electronic display module

**500**. A trio of latches **130**, **132**, and **135** may be placed at the bottom of the cover/bracket **550** and correspond to the latches **121**, **122**, and **125** on the module **500** respectively. Of course, as noted above, only a single latch or a pair of latches may be used in some embodiments. A pair of mounting hooks **300** and **301** are preferably placed at the top of the cover/bracket **550** and correspond to the mounting pins **50** and **51** respectively. Preferably, the hook **300** would wrap around a portion of the circumference of the mounting portions **55**, where the hook **300** is stabilized laterally between the walls **54** and **53**.

FIG. **4** is a detailed front perspective view of Detail B shown in FIG. **3**. A fitting **285** may permit conduit (not shown) to seal with the sidewall **225** and allow the service wire **281** to pass through the sidewall **225** to meet the junction box **280**.

FIG. **5** is a detailed front perspective view of Detail C shown in FIG. **3**.

FIG. **6** is a front perspective view of the exemplary method for attaching the electronic display assembly module **500** to the hybrid rear cover and mounting bracket **550**. Once the cover/bracket **550** has been mounted to a vertical surface (and preferably after the service wiring has been ran to the junction box), the module **500** may hang from the interaction of the hooks **300/301** with the pins **51/50**. At this point, the bottom of the module **500** can be rotated outwardly so that the gas springs **250** can be attached to the module **500**. Once these are attached, the hooks **300/301** remain within the pins **51/50** but the bottom of the module **500** is held away from the cover/bracket **550** so that the module **500** can be electrically connected with the junction box **280**. Once the module **500** is electrically connected, the bottom of the module **500** is rotated towards the cover/bracket **550** until the latches at the bottom of the two assemblies can be engaged.

FIG. **7** is a front elevation view of the hybrid rear cover and mounting bracket **550** once assembled with the electronic display assembly module **500** and indicating the section line A-A.

FIG. **8** is a partial section view taken along the section line A-A and showing the top portion of the assembly. When the latches at the bottom of the two assemblies engage, the gasket **90** is preferably compressed against the rear plate **220** to define the plenum **91**. A front cover transparent plate **410** is preferably placed in front of the electronic display and a flow of external air **100** is shown travelling behind the electronic display and through the channel **120**. Although any type of flat panel electronic display could be used, this particular embodiment uses an LCD display **400** with a direct LED backlight **430**. Thus, in this embodiment, the channel **120** is defined between the rear surface of the LED backlight **430** and the thermal mounting plate **81**. However, alternative embodiments may utilize any type of flat panel electronic display, including but not limited to plasma, OLED, electroluminescent polymers, or similar where the channel **120** is defined between the rear surface of these displays and the thermal plate **81**.

FIG. **9** is a partial section view taken along the section line A-A and showing the bottom portion of the assembly. The fan **80** is preferably positioned to draw the external air **100** through the channel **120**, along the rear portion of the backlight **430** (or electronic display), and exhausted out of the bottom of the assembly. Of course, the external air **100** could also be ingested at the bottom and exhausted out of the top. The fan **80** is preferably placed within a cavity defined between the backlight **430** and the rear plate **220** and is preferably not immediately adjacent to the exhaust port on



5

the housing, although this is not required. Generally speaking, a portion 201 of the housing may connect between the rear surface of the backlight 430 (or electronic display) and the rear plate 220, where the fan 80 is mounted on this portion 201 of the housing.

Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

We claim:

1. A system for mounting an electronic display comprising:

a rear cover mounting bracket having a rear plate;  
an electronic display assembly module having a thermal plate where the electronic display assembly module attaches to the rear cover mounting bracket to define a gaseously sealed enclosed chamber between the thermal plate and the rear plate, wherein said enclosed chamber is located entirely behind the electronic display assembly;

an electrical component placed within the enclosed chamber;

wherein the electronic display assembly module is removably connected to the rear cover mounting bracket;  
a first partition within the enclosed chamber; and  
a circulating fan positioned within the enclosed chamber for circulating gas within the enclosed chamber.

2. The system of claim 1 further comprising:

a plurality of mounting holes placed within the rear plate; the mounting holes are placed outside of the enclosed chamber; and

wherein the rear cover mounting bracket has a sidewall which surrounds a perimeter of the plate.

3. The system of claim 2 wherein:

the circulating fan is positioned on the first partition; and the circulating gas is air.

4. The system of claim 1 wherein:

the rear plate is adapted to fit against a vertical surface.

5. The system of claim 1 further comprising:

a channel defined by the space between an electronic display and the thermal plate; and

a fan positioned to draw external air through the channel but not through the enclosed chamber.

6. The system of claim 1 further wherein the bottom side of the electronic display assembly module is adapted to rotate outwardly away from the rear cover mounting bracket when the electronic display assembly module is attached to the rear cover mounting bracket.

7. The system of claim 1 further comprising:

a pair of hooks attached to the rear plate; and  
a pair of round posts attached to the electronic display assembly module which fit within the hooks and allow the electronic display assembly module to hang from the hooks.

8. The system of claim 1 wherein the electrical component is a power module.

9. The system of claim 1, further comprising:

a second partition within the enclosed chamber that is oriented substantially perpendicular to the first partition;

6

wherein the circulating fan is positioned on either the first or the second partition for circulating gas around the enclosed chamber; and

wherein the gas within the enclosed chamber circulates in a loop pattern when the enclosed chamber is sealed.

10. A system for mounting an electronic display comprising:

a rear cover mounting bracket having a rear plate;

a pair of hooks attached to the rear plate;

an electronic display assembly module containing an electronic display and having a pair of horizontal posts, each post being sized to fit within a hook so that the electronic display assembly module can hang from the hooks, the electronic display assembly module having a thermal plate wherein the electronic display assembly module attaches to the rear cover mounting bracket to define a plenum between the thermal plate and the rear plate;

an electrical assembly placed within the plenum;

a latch positioned near the bottom of the electronic display assembly module;

wherein the electronic display assembly module is adapted to allow the bottom of the electronic display assembly module to rotate outwardly away from the rear cover mounting bracket when the electronic display assembly module is attached to the rear cover mounting bracket;

a first partition within the plenum;

a second partition within the plenum that is oriented substantially perpendicular to the first partition;

a circulating fan positioned on either the first or the second partition for circulating gas around the plenum; and

wherein the gas within the plenum circulates in a loop pattern when the plenum is sealed.

11. The system of claim 10 further comprising:

a plurality of holes in the rear plate for attaching the rear plate to a wall.

12. The system of claim 10 further comprising:

a pair of locating walls positioned on each post where the space between the locating walls defines an area of each post that is accepted by the hook.

13. The system of claim 10 further comprising:

a channel within the electronic display assembly module that is defined by the space between the electronic display and a thermal plate;

a fan positioned to force external air through the channel.

14. The system of claim 10 wherein the electrical assembly is a power module.

15. A method for mounting an electronic display comprising the steps of:

attaching a rear cover mounting bracket to a vertical surface, said rear cover mounting bracket having a pair of hooks positioned near a top of the rear cover mounting bracket;

presenting an electronic display assembly module having a thermal plate and a pair of horizontal rods near a top of the electronic display assembly module;

engaging the horizontal rods with the hooks so that the electronic display assembly module can hang from the hooks;

rotating a bottom portion of the electronic display assembly module outwardly away from the rear cover mounting bracket when the electronic display assembly module is attached to the rear cover mounting bracket;



attaching a bottom portion of the rear cover mounting  
 bracket to the bottom portion of the electronic display  
 assembly module;  
 creating an enclosed chamber between the rear cover  
 mounting bracket and the thermal plate; 5  
 placing an electrical assembly within the enclosed cham-  
 ber;  
 placing a first partition within the enclosed chamber;  
 positioning a circulating fan in the enclosed chamber for  
 circulating gas within the enclosed chamber; and 10  
 circulating the gas in a loop pattern around the first  
 partition when the enclosed chamber is sealed.

**16.** The method of claim **15** wherein:

the entire weight of the electronic display assembly  
 module is permitted to hang from the hooks once 15  
 engaged with the horizontal rods.

**17.** The method of claim **15** wherein:

the step of engaging the horizontal rods with the hooks  
 comprises placing the hook on a portion of the rod  
 which is defined by the space between a pair of locating 20  
 walls.

**18.** The method of claim **15** wherein:

the step of attaching the rear cover mounting bracket to  
 the electronic display assembly module comprises  
 engaging a first portion of a latch which is attached to 25  
 the rear cover mounting bracket with a second portion  
 of a latch which is attached to the electronic display  
 assembly module.

**19.** The method of claim **15** wherein:

the step of attaching the rear cover mounting bracket to 30  
 the electronic display assembly creates the enclosed  
 chamber which is sealed from the exterior air.

\* \* \* \* \*

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 10,212,845 B2  
APPLICATION NO. : 15/494614  
DATED : February 19, 2019  
INVENTOR(S) : William Dunn et al.

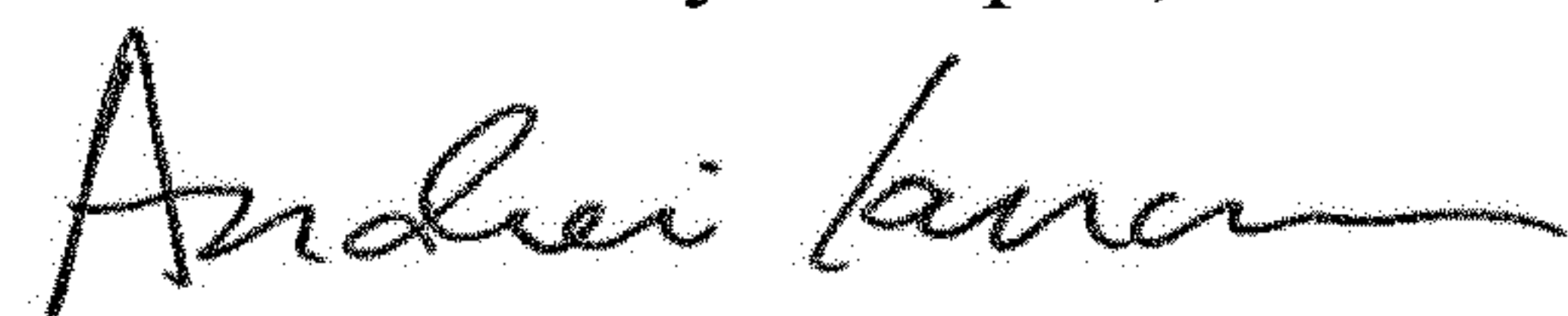
Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

On page 4, Column 1, Line 8 under References Cited U.S. Patent Documents, U.S. Patent Application No. 2009/0009041 reference, please delete inventor name "Leidler" and replace with inventor name - Zeidler -.

Signed and Sealed this  
Second Day of April, 2019



Andrei Iancu  
*Director of the United States Patent and Trademark Office*